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Assessment of Commercial Agroforestry and Government Initiatives in *Jhum* Areas of Karbi Anglong, Assam, India

Vulli Dhanaraju*[1], Junmoni Hansepi[2], Raj Kumari Bijeta[3], Rashmi Engtipi[4]

[1]Department of History, North-Eastern Hill University (NEHU), Shillong, Meghalaya, India.
Email: vullidhanaraju@gmail.com | ORCID: http://orcid.org/0000-0002-5559-1077
[2]Department of History, Bhattadev University, Pathsala, Assam, India.
Email: zunmonih@gmail.com | ORCID: https://orcid.org/0009-0007-4022-2723
[3]Department of History, Indira Gandhi National Tribal University (IGNTU), Amarkantak, Madhya Pradesh, India. Email: rkbijeta@igntu.ac.in | ORCID: http://orcid.org/0000-0002-3145-5564
[4]Department of History, Don Bosco College, Diphu, Assam, India.
Email: rashmiengtipi1@gmail.com | ORCID: https://orchid.org/0009-0003-8238-8773
**Corresponding author*

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Abstract

Scholars and policymakers commonly recognize agroforestry as an integrated approach to environmental conservation and enhancing agricultural productivity. This study seeks to examine the status of commercial agroforestry and governmental activities aimed at regulating shifting cultivation in the Karbi Anglong region of Assam, India. Commercial agroforestry often refers to the large-scale production of agricultural and forestry products for commercial purposes. The primary objective is to market and sell products, such as tea or coffee, while utilizing the shelter provided by shade trees. The data was collected systematically using the purposeful sampling method. A total of six villages were chosen for sample collection, and 36 samples were collected to assess the level of satisfaction with the government's commercial agroforestry initiatives, as well as the respondent's opinion on the ground. The study applied critical analysis and interpretative techniques to qualitative data, while descriptive techniques were used to examine statistical data collected from government reports. This study observed that the local government framed several schemes to conserve three essential natural resources: soil, water, and vegetation. According to the study, the Cash Crops Development Programme was important in reducing the *jhum* (shifting) cultivation in the study area. However, accepting the changing scenario of agricultural practices in the hill tribal areas of Karbi Anglong, this study interpreted that commercial agroforestry plays a significant role in the changing life of the people, as well as improving agricultural productivity, diversifying income streams and restoring ecological balance in the study area.

Keywords

Biodiversity**;** Cash crop plantation**;** Ecosystem**;** Shifting cultivation**;** Soil conservation

Introduction

Jhum cultivation, also known as slash-and-burn agriculture or shifting cultivation, is a traditional farming method used by local communities in hilly terrains of northeast India (Bhuyan, 2019; Chatterjee, 2021; Dhanaraju, 2023; Dhanaraju and Bijeta, 2022; Gupta, 2000; Haokip *et al.*, 2021; Kerkhoff and Sharma, 2006; Mathur and Bhattacharya, 2022; Malik, 2003; Rasul and Thapa, 2003). This type of agriculture is one of the oldest, and it may be found in many places of the world, including America, Asia, and Africa (Santoro *et al.,* 2020). It involves clearing a specific piece of land, cultivating it temporarily, and then abandoning it to allow natural vegetation to regenerate. Shifting cultivation currently accounts for approximately 86% of all agricultural land in northeast India (Haokip et al., 2021). Such agricultural practices are closely connected to the cultural practices of most of the tribes in this region. It is a widely accepted opinion that shifting cultivation was the first type of agriculture and that it fulfilled the fundamental needs of humanity. Currently, this farming method, along with other old systems, is regarded as an exemplary model of ecological efficiency. Mixed cropping was often done in the *jhum* land. The subsistence hill farmer normally cultivates all the crops required for their household sustenance. More than 50 per cent of the inhabitants in Karbi Anglong engage in *jhum* cultivation, which involves clearing vegetation along the hill slopes (Hansepi and Laisram 2022). However, the percentage of production varies from season to season (HADP, 2015). The cultural practices of the indigenous population in this area are governed by the "*jhum* calendar". The celebration of traditional festivals coincides with various activities of *jhum* farming. Recently, the state and policymakers have become greatly concerned about shifting cultivation and the decline of the vegetation cover. New policies have been implemented by the state and policymakers to regulate *jhum* and bamboo cultivation. They claim that *jhum* cultivation is highly detrimental due to its contribution to erosion, forest degradation, low production, and exacerbation of flooding, which eventually results in environmental imbalances (Mathur and Bhattacharya, 2022).

In this context, the government and policymakers have suggested alternate farming methods that can challenge the current practices of shifting cultivation in northeast India. Pant, and his team members (2018), in their latest report, have suggested that the Ministry of Agriculture should initiate a "mission on shifting cultivation" to promote coordination across different ministries and address the practice of shifting cultivation, which is predominantly observed in the north-eastern states. This initiative was taken due to the significance of the problem and to enhance livelihoods, eliminate poverty, and prevent land degradation. Their report also stated that effectively managing the transformation of shifting agricultural lands is an intricate procedure that necessitates the active involvement of various ministries and organizations. This report advocated that land for shifting cultivation be classified as agricultural land under 'agroforestry'. Because of the decreases in productivity that come with rising population pressure, shortening of fallow times, and the lack of availability of alternative land, shifting agriculture is currently considered to be a type of agroecosystem that is largely unsustainable (Nath *et al.,* 2016). As a means of improving shifting farming systems, a growing number of programs have been developed to promote the use of agroforestry to boost agricultural productivity. Shifting cultivation is currently regarded as an extensively unsustainable form of agriculture due to reduced production resulting from

growing population pressure, shortening of fallow periods, and lack of alternative land. To improve changing agricultural systems, there has been an increase in the number of efforts that are being made to increase the adoption of agroforestry. In 2014, the government of India launched the National Agroforestry Policy to improve productivity, profitability, variety, and ecosystem sustainability, making it the first government to do so globally (Patel *et al.*, 2024).

Agroforestry is commonly recognized by scholars and policymakers as an integrated approach to both environmental conservation and enhancing agricultural productivity (Bhandari, Joshi and Paudel, 2021; Deb, 2020; ICFR, 2020; Mathur and Bhattacharya, 2022; Patel *et al.,* 2024). Agroforestry, a traditional method, is a significant kind of subsistence farming (ICFRE, 2020). NITI Aayog (formerly Planning Commission) characterizes agroforestry as an agroecological, nature-based land use system that simultaneously addresses current ecological issues, including food, nutrition, energy, employment, natural resources, and environmental security (Patel *et al.,* 2024). Agroforestry indeed encompasses both traditional and modern techniques of land utilization. Improving the quality of the soil, increasing the amount of vegetation, and increasing the amount of tree cover can be accomplished by integrating and optimizing the interactions between the components of agroforestry, which include trees, crops, and livestock. Agroforestry has the potential to meet the needs of climate change adaptation and mitigation while also delivering several short-term and long-term advantages to society and the economy. Due to the current scenario in India's land usage patterns, the NITI Ayog emphasized the need for immediate involvement in the promotion of agroforestry in areas of shifting cultivation.

The government statistical reports show that agroforestry products and services directly support 1.2 billion people in developing countries, both rural and urban (ICFRE, 2020). Indeed, India is the first nation in the world to have a distinct policy for the agricultural practice known as “agroforestry”. The objective of that approach is to encourage better coordination, convergence, and interaction among many of the agroforestry components that are dispersed across different missions, programs, and schemes that are already in place. According to the National Agroforestry Policy 2014, the term “agroforestry systems” encompasses both traditional and modern land-use systems. These systems involve the sustainable management of trees in conjunction with crop and/or animal production systems in agricultural environments. Agroforestry can be practiced in both irrigated and rainfed environments depending on the conditions of the land. This practice results in the production of food, fuel, fodder, timber, fertilizer, and fibre. It also contributes to the security of food, nutrition, and the environment. Additionally, it helps to support livelihoods, reduce poverty, and promote environments that are productive and resilient for cropping and farming. The role of agroforestry in the socio-economic empowerment of local inhabitants has been underlined by a variety of national efforts, in addition to the policy frameworks that have been discussed above. For instance, the National Forest Policy of 1988, the National Agriculture Policy of 2000, the Planning Commission Task Force on Greening India of 2001, the National Bamboo Mission of 2006, the National Policy on Farmers of 2007 and the Green India Mission of 2010 etc., emphasized on the role that agroforestry plays in promoting efficient nutrient cycling, organic matter addition for sustainable agriculture, and the enhancement of vegetation cover (ICFRE, 2020). It can be understood from the policymakers that agroforestry is

the only practical method for achieving the 33% green cover target set by the National Forest Policy, 1988.

Agroforestry can improve ecosystem services by storing carbon, preventing deforestation, protecting biodiversity, and conserving soil and water. Initially, scientists have classified agroforestry into four groups based on the system's structure, function, ecological spread, and socio-economic basis (Nair, 1987). Subsequently, Dwivedi (1992) rearranges this basis into seven categories as follows: The categories mentioned are: structure, physiognomic, function, floristic, socio-economic, historical, and ecological (Hasanuzzaman, 2024). Agroforestry systems are categorized into three types based on socio-economic considerations: Subsistence agroforestry system, Commercial agroforestry system, and Intermediate agroforestry system. This study examines the impact of commercial agroforestry on the economic and social well-being of the local population in the *jhum* areas of the Karbi Anglong region in Assam. Commercial agroforestry often refers to the large-scale production of agricultural and forestry products for commercial purposes (Dhiman, 2013). The primary objective is to market and sell products, such as tea or coffee, while utilizing the shelter provided by shade trees. Traditional agroforestry is less effective since its primary purpose is to meet the family's consumption needs or subsistence system, whereas commercial agroforestry is focused on cultivating tree products to increase income.

The main aim of this study is to analyze the status of commercial agroforestry and government initiatives aimed at controlling shifting cultivation in the Karbi Anglong region of Assam, India, while examining the ground realities of schemes that have been implemented in the field. Given this objective, this study will serve as an example for the government, demonstrating how commercial agroforestry has benefited people while also balancing the significance of shifting cultivation. Keeping in mind the aim of the study, this study framed the following objectives:

1) To study the impact of commercial agroforestry on the socioeconomic status of the people in the study area; and
2) To evaluate the impact of cash crop plantation programs on agroforestry in the study area.

Methodology

Study Area

Geographically, Karbi Anglong of Assam is divided into two territorial parts: hills and plains. The Karbi Anglong Autonomous Council (KAAC) administers two districts of Karbi Anglong (East and West) and these two districts have been placed under the sixth schedule of the Indian Constitution. This region covers 10,434 sq km, accounting for approximately 13.53% of the state's overall geographical area of 78,438 sq. km. Karbi Anglong is an important hill region in Assam. This region of rich tropical forest-covered hills and plains is located between latitudes 25°33' and 26°35' north and longitudes 92°10' and 93°50' east. This study covered three territorial forest divisions (East Division, West Division and Hamren Division) of Karbi Anglong Autonomous Council. Historically, this district's population has been largely tribes, with Karbi being the largest tribe (District Census Handbook, 2014).

Data Collection

The study was conducted from 2021-2022. The primary data was obtained purposely from the study area where the KAAC's agroforestry programs are being implemented. The study applied qualitative research techniques to collect data from respondents engaged in commercial agroforestry in *jhum* cultivation areas to assess the impact of government programs. The respondents have been spread across three divisions (Diphu, Silojanijan and Phuloni) of Karbi Anglong. Since the study is qualitative, the purposive sampling technique was employed to obtain primary data. A total of 6 villages were chosen for the collection of the samples, and 36 samples were collected to evaluate the degree of satisfaction with the commercial agroforestry efforts that were implemented by the government, as well as the opinion of the government at the ground level. The selection of these six villages was based on their homogeneity (Karbi community), with respondents actively engaged in commercial agroforestry and having made use of government-initiated commercial agroforestry projects/schemes. The study also used participant observation, and selected interviews with individuals engaged in commercial agroforestry to collect primary data in Annexure-1 format. However, the obtained data were corroborated with official records to evaluate the agroforestry programs. The study also conducts interviews with forest officials (government) to obtain official government data. Secondary data were employed in this study. These sources have been collected from the relevant government publications, including Annual Souvenirs of KAAC, Forest Reports of Assam State, NITI Aayog Reports on Agroforestry, and National Agroforestry Reports. The main limitation of the study is the unavailability of recent reports on the study area; hence, the assessment was based on previous data from official reports.

Data Processing and Analysis

This study applied qualitative research approaches to acquire primary data, while quantitative procedures were also used for statistical data. For the qualitative data, the study used critical analysis and interpretative techniques, whereas the statistical data was analysed using descriptive techniques. SPSS/STATA 14 is used for data entry and quantitative analysis of the data collected from the reports and field. This study employed critical analytical and interpretative methods on the gathered data to understand the subjective dimensions of the respondents in the field. It also evaluated the government schemes to ascertain their effects on the socio-economic conditions of the people and the changing scenario of shifting cultivation in the study area. These techniques further enable this study to understand the challenges faced by those engaged in commercial agroforestry. The critical analysis and interpretive technique were employed to also examine the secondary data, specifically the government reports and literature review used in this study.

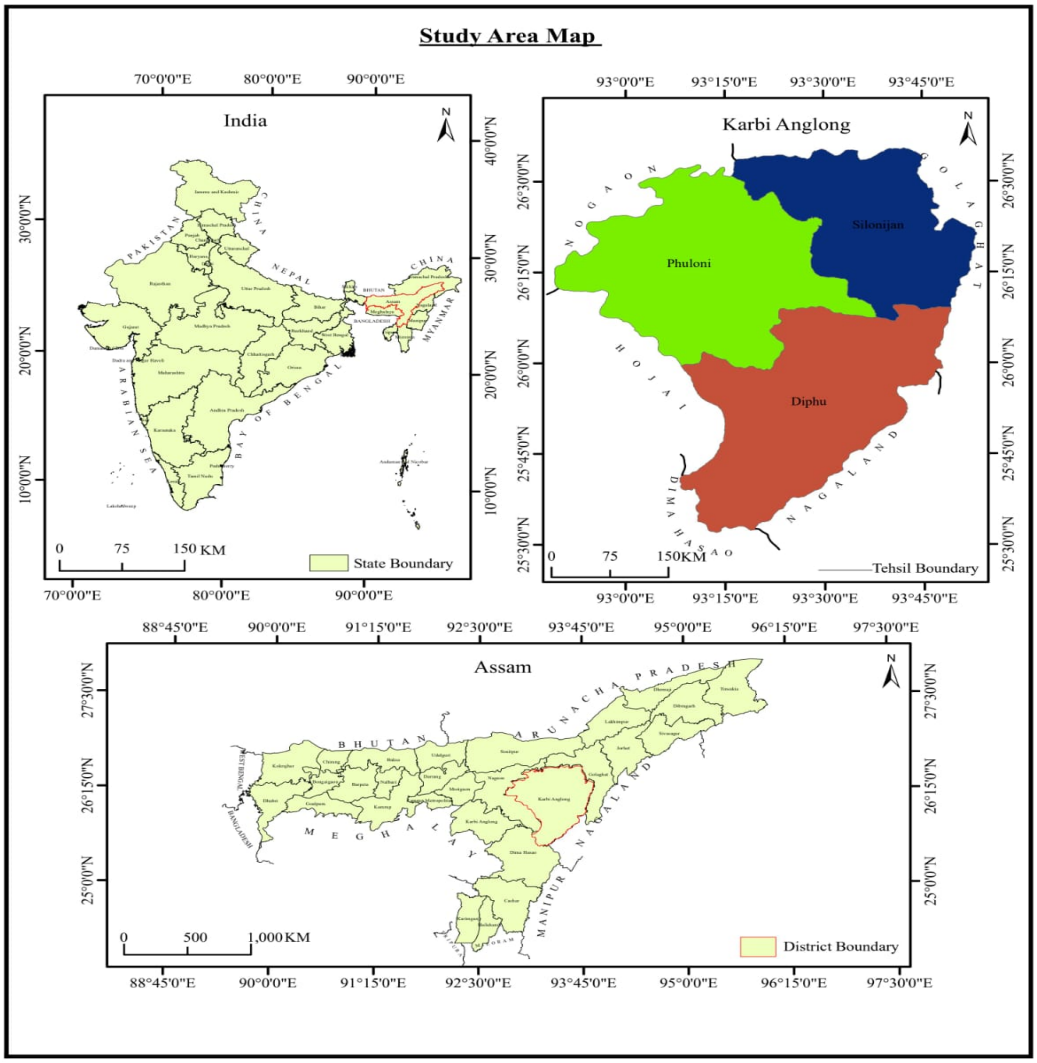

Figure 1: Map of the study area

Results and Discussion

The Status of Jhum *Cultivation*

For the last few decades, traditional methods in *jhum* cultivation in northeast India have been a subject of much debate among researchers and an issue of concern for governments. In Karbi Anglong, the use of land is central to all socioeconomic activities. The predominant land use pattern and traditional economic activities are *jhum* cultivation. In *jhum* land, mixed cropping is practised, and the ground is never left fallow. The subsistence hill farmer cultivates all the essential crops necessary for household consumption. People cultivate continuously throughout the year. The main crops planted were upland hill rice, maize, sesame, cotton, gourd, chilli, ginger/turmeric, chilli, rabi vegetables, and kharif vegetables.

Table 1: The extent of land used for *jhum* cultivation in northeast India

State	*Area (sq.km)*		
	2005-06	*2008-09*	*2015-16*
Arunachal Pradesh	1025.07	821.67	509.11
Assam	160.15	82.02	52.60
Manipur	752.10	296.68	499.96
Meghalaya	291.87	281.73	237.87
Mizoram	1028.53	602.08	691.55
Nagaland	1239.09	1414.53	979.33
Tripura	89.28	30.31	65.17
Sikkim	-	58.98	92.09
Total	4586.09	3588.00	3127.68

Source: Haokip *et al.* (2021)

Research conducted by the Assam Remote Sensing Application Centre using satellite data indicates that *jhum* (shifting) cultivation is expanding at an annual rate of 1.2% in the hill district of Karbi Anglong, affecting approximately 60.01% of the total land area (HADP, 2016). Mixed agriculture was commonly practiced in the *jhum* terrain.

The Impact of Commercial Agroforestry and Government Initiatives

The agroforestry area in the Northern Himalayan Region is 4.096 million hectares out of the overall geographical area of 32.968 million hectares, which accounts for 2.42%. (Arunachalam *et al.*, 2022; NITI Ayog, 2024). The KAAC has made significant progress in the scientific and sustainable management of forest resources. Green felling has been completely banned since 1995. The survey of forest areas for sustainable harvesting of timbers and minor forest products in perpetuity to meet genuine developmental and local needs has been conducted. The Autonomous Council has implemented several initiatives to regulate the practice of *jhum* cultivation. The authorities have implemented some initiatives, such as the development of model villages, the Cash Crop Plantation Scheme, and the Composite Scheme, among others (KAAC, 2016). The state government, in collaboration with the KAAC, has implemented a variety of State Plan Schemes to restrict shifting cultivation among Karbis. Various projects known as the Compact Areas Programme/Mini Compact Areas Programme were implemented as part of the Integrated *Jhumia* Development Programme (IJDP) till 1994-1995 (HADP, 2016). However, in 1995-96, the Karbi Anglong Autonomous Council changed and established plans to encourage the planting of environmentally friendly cash crops like as tea, coffee, rubber, bamboo, and sugarcane. Such initiative led to the launch of commercial agroforestry schemes in Karbi Anglong. In addition to cash crop plantation, various schemes such as land development/land reclamation, water harvesting structures with water distribution systems, dug-out ponds, and river training works are now being implemented. The IJDP schemes are implemented by the various departments under the guidance of KAAC administrative jurisdiction. According to Council officials, the primary goal of the IJDP is to move away from traditional *jhum* cultivation and toward land-based permanent cultivation, the use of fertilizers or manure, and other modern methods of cultivation. In addition, soil erosion and loss of fertility have resulted in decreased productivity in the area. Currently, the IJDP is a subject that has been given a high level of trust by the state (KAAC, 2015a).

The Hill Areas Department (HAD) of the state government is providing a one-time grant to the Council as part of the budgeted allocation for support. The fund allotment is distributed on a 50:50 basis. The Soil Conservation Department Souvenir of 2005 stated that *jhum* cultivation continues to span 69,000 hectares of hilly tract out of the district's overall geographical area of 10, 33,200 ha per year (KAAC, 2005). This traditional agricultural approach is a major cause of environmental deterioration, which hurts the region's ecology. Apart from this, soil erosion and a loss of fertility have reduced output in the area. The HAD is providing the Council with one-time assistance in the form of a grant in aid, as allocated in the budget. Funds are allocated in 50:50 ratios (HADP, 2016).

Table 2: Allocation of funds for the Integrated Joint Development Programme (IJDP) in Karbi Anglong since 1998

Year	*Amount Received (in USD)*
1998-1999	91,851.36
1999-2000	87,774.45
2000-2001	99,455.36
2001-2002	87,774.45
2002-2003	76,050.20
2003-2004	2,04,749.49

Source: KAAC (2015)

The Council Authority decides which schemes are included in the Integrated Jhumia Development Programme. The schemes are then included in the annual action plan for the year and presented to the HAD for funding release. After receiving funding, the assigned department funds are sanctioned and distributed when they are implemented. Cash crops such as tea, rubber, bamboo, and sugarcane are included, while other programs include land development/reclamation, water harvesting structures with water distribution systems, dug-out ponds, and river training works. Training sessions and awareness initiatives are also arranged. Mini projects on a watershed basis have been implemented from 2003-04 (KAAC, 2015).

The Council representatives and the Implementation Committee select project sites based on the priority of individual proposals from humans. Beneficiaries typically select regions from the *jhumias*, therefore, such plans are implemented in abandoned *jhum* lands. The IJDP schemes are beneficiary-oriented, with 100% financing provided before being given out to selected beneficiaries. Cash crop plantation locations are chosen from lands held by the beneficiaries. Plantations are maintained for two or three years, depending on the requirements. However, the sugarcane plants are not supported by the IJDP funds. There are no such tree/crop species that have been selected for implementation under the IJDP. Because the Forest, Agriculture, and Soil Conservation Department grows cash crops according to distribution formulas that benefit them. The District Agriculture Officer (DAO) is responsible for implementing the sugarcane cultivation scheme (KAAC, 2005). The programs related to tea, coffee, rubber, and sugarcane are executed by departmental regulations. Tea plantation regulations have been developed by Agriculture University standards. The schemes for land development/reclamation and water harvesting structures are carried out by the plan and estimates approved by the Council Authority.

The IJDP has initiated the Cash Crops Development Scheme. Before 1995-96, several integrated approach programs including veterinary care, handloom textiles, horticulture, and terrace agriculture were implemented pragmatically. However, due to several implementation challenges, the outcome was not as intended. The marginal farmers successfully carried out 156 ha of tea production as part of the cash crop plantation. Rubber has been popular with *Jhumia* families since 2006. The Council launched the Cash Crops Development Programme under agroforestry to promote cash crops like rubber, coffee, and tea as alternatives for transforming humans into permanent agriculture. These income-generating crops contribute to the generation of livelihoods while also minimizing erosion of the soil. During 2015-2016, 87.4 hectares of rubber plantations and 34 hectares of tea plantations were established at the beneficiary level. However, it does not suit the needs of greater groups of people (HADP, 2016).

Bamboo and broom plantations are common among humans. These plantings not only serve to reduce soil erosion in mountainous terrains, but they also generate a quick income. During 2015-2016, 56.7 hectares of bamboo plantation and 5.75 hectares of broom cultivation were raised, benefiting 66 beneficiaries. Another interesting finding is that the government has adopted protective afforestation. Protective afforestation includes steeply sloping and degraded land that is unsuitable for crops. Multipurpose tree species, medicinal plants, and forest species have been cultivated. These forest species plantations help to protect soil erosion and conserve biodiversity in the region. During 2015-2016, 40 hectares of land were brought under the plan. To raise awareness about environmental conservation, the department has been implementing the Nature Conservation Project, which involves planting ornamental plants, flowering plants fruit-bearing tree species in places like schools, public spaces, and roadside. During 2015-2016, 15,000 trees were planted under the project. Special sugarcane farming under IJDP has been implemented from 2002-03 to replace shifting cultivation as a sustainable crop. In recent years, sugarcane agriculture has reached an area of 1250 bighas. Sugarcane is currently the most common cash crop among humans. It has marketing opportunities in rural markets. 1000 families have benefited from it (KAAC, 2015).

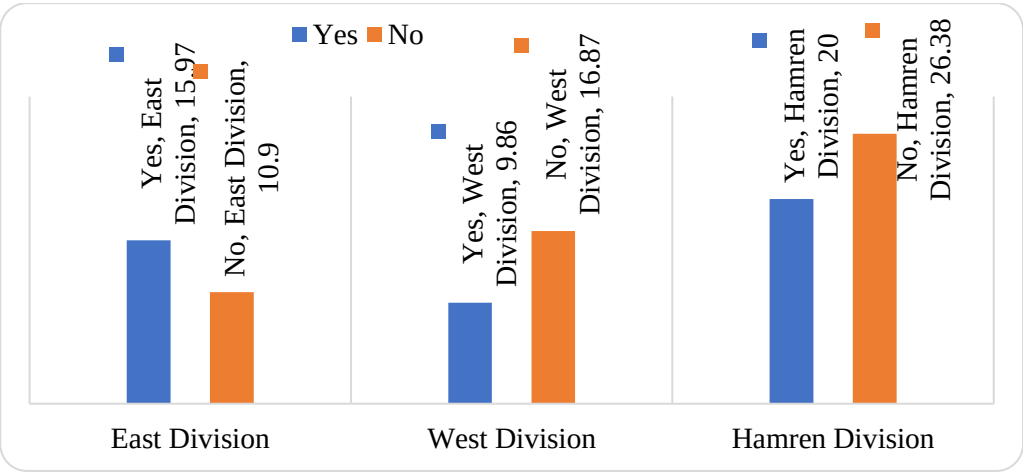

Figure 2: Percentage of beneficiaries under the Integrated *Jhumias* Development Programme (IJDP)

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Figure 2 depicts the percentage of respondents who benefited from the IJDP in three Forest Divisions of Karbi Anglong. Only a small percentage of those who responded have benefited from the scheme in these forest divisions. Soil and water conservation methods have a vital role in preventing soil erosion in the hills of Karbi Anglong. The Soil Conservation Department, which is under the Council's administrative control, is responsible for the most effective and profitable management of three vital natural resources: soil, water, and vegetation, through the implementation of various activities, as well as the generation of self-employment and the improvement of the socioeconomic conditions of rural people throughout the district. The council has launched several major soil conservation schemes to promote agroforestry in Karbi Anglong, including the Cash Crop Development Programme, Bamboo and Broom Plantation, Nature Conservation, Protective Afforestation, and so on.

Table 2: The Status of Commercial Agroforestry under the State Plan and Hill Areas Development Programme (HADP) for the financial year 2014-15

Name of Scheme	*Achievement under Normal Plan*		*Achievement under HADP*	
	Finical in USD)	*Physical (Area and Numbers)*	*Finical (Rs in Lakhs)*	*Physical (Area and Numbers)*
Rubber Plantation	1,07,865.62	251 ha	60.61	69.0 ha
Rubber Budded Nursery	25,717.72	31405	19.09	2600
Tea Plantation	22,301.04	47nos	32.17	26.6ha
Tea Nursery	14,040.71	200000	6.83	12000
Nature Conservation	17,612.46	39	4.47	9
Bamboo Plantation	36,149.44	131 ha	20.67	46.4 ha
Protective Afforestation	3,581.87	19	1.65	10 ha
Composite Nursery	2,575.22	22000	…….	……

Source: KAAC (2015)

Table 3 shows the Cash Crop Development Schemes under the State Plan (Normal Plan) and HADP for the financial year 2014-15. As previously observed, the Council developed Cash Crop Development Schemes under agroforestry to mitigate shifting cultivation in Karbi Anglong. Rubber budded nursery and composite nursery were the most successful of these projects, while tea nursery came in second in terms of achievement and number of beneficiaries. According to the records, the percentage of beneficiaries and successes was quite low when compared to the total number of bamboo plantations in this district. Bamboo plantations are cultivated by about 90% of the population in Karbi Anglong. The study observed that different land development schemes have been implemented by the department to increase cultivable areas that lead to cropping intensifying in *jhum* areas. However, it is inconsistent with the anticipated parameters set forth by the government.

Table 4 shows how KAAC contributes to the growth of cash crops and land by developing various initiatives and activities. The primary goals of these programmes aim to turn *humans* into permanent agriculture by incorporating local communities in cash and land development. However, the success rates of these plans do not meet the standards we have witnessed in the field. According to the field survey, these plans do not reach those living in remote locations. The principal consequence of these initiatives revealed that the conversion of forest land into commercial agricultural lands such as

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tea, orange, and rubber plantations resulted in the depletion of a significant forest area, particularly in the Koiamati, Panjan, Jongpha, Phangcherop, and Borlangso districts of the East Forest Division. Langkhersa has a tea plantation, while Amreng has an orange plantation, both under the Hamren Forest Division. With the current surge in the number of small tea gardens, many forest covers must give way to tea plantations, leading the total forest area to decline even further. The growth of settled agricultural practices has caused forests and grasslands to shrink (Bhuyan, 2019).

Table 3: Beneficiaries of Commercial Agroforestry Schemes from 2002-03 to 2005-06

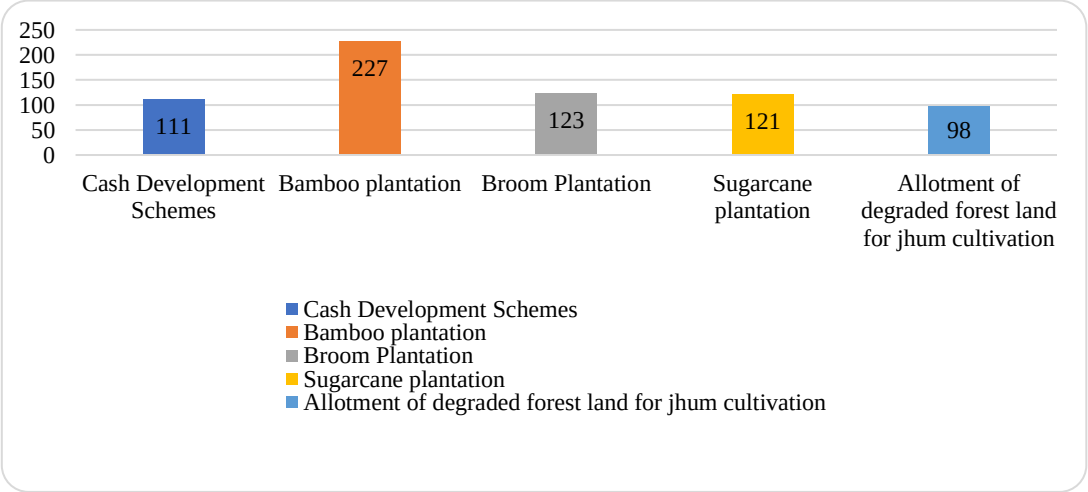
Sl.No.	*Name*	*Achievement during*					*The total number of families benefited.*
		2002-03	*2003-04*	*2004-05*	*2005-06*	*Total of four years*	
1.	Protective Afforestation	-------	61 ha	-------		61.0 ha	-------
2.	Bamboo Plantation	253.00 ha	200.00 ha	130.00 ha	299.0 ha	882.00 ha	1250
3.	Broom Plantation	------	6 ha	5 ha	10.00 ha	21.00 ha	42
4.	Coffee Plantation	5.00 ha	12.00 ha	-----	------	17.0 ha	8
5.	Tea Plantation	-----	-----	------	2.00 ha	2.00 ha	1
6.	Rubber Plantation	-----	7.2 ha	9.00 ha	37.00 ha	53.20 ha	90
7.	Nature Conservation Project	1	2	12	33	48	35
8.	Land Reclamation Land Development	47.50 ha	89.00 ha	23.00 ha	225.00 ha	384.50 ha	632
9.	Water Harvesting/ Distribution	11	39	19	82	151	160
10.	Terracing	7.00 ha	5 hat	5.00 ha	15.00 ha	32.00 ha	54

Source: KAAC (2016)

The council authorities have justified rigorous monitoring of forest management by stating the following reasons: Rapid population expansion and influx from neighbouring states led to encroaching forests, destroying valuable crop cultivation areas; *jhum* cultivation gradually damaged forests, eventually leading to their destruction; granting forest leases/coups without sufficient consideration is a leading cause of forest devastation and youth who lack a stable source of income often illegally cut down plantation trees for profit. Figure 3 shows beneficiaries under the Integrated Jhumias Development Programme (IJDP) scheme in the study region, as mentioned in the reports of the KAAC. The Council implemented several measures to persuade cultivators to stop

growing *them*. This table shows the variation in success rates among the people who benefited from this scheme.

Figure 3: Beneficiaries who have gained advantages from the Integrated Jhumias Development Programme (IJDP)



The primary occupation of the inhabitants in the study area is agriculture. A significant number of individuals engage in *jhum* cultivation, a traditional important and age-old agricultural practice. This practice characterized by the traditional slash-and-burn technique, has been embraced by communities for generations. The local and state governments express concern that the increasing population pressure and the resulting reduction of the *jhum* cycle are significant factors contributing to environmental degradation, adversely affecting the region's ecology. The phenomenon of deforestation is contributing to soil erosion, reduced crop yields, diminished groundwater recharge, increased surface runoff, and a lowering of groundwater levels. In this context, the government has undertaken initiatives to cultivate an alternative economic system within *jhum* cultivation areas. Agroforestry has been embraced as a strategy to address the aforementioned ecological challenges.

Commercial agroforestry has been developed to encourage initiatives such as bamboo, broom, coffee, tea, and rubber plantations, together with soil conservation strategies, nature conservation projects, land reclamation, land development, water harvesting and distribution, and terracing. These schemes played a significant role in the socio-economic life of people. In the study area, the KAAC has instituted a variety of measures aimed at governing the practice of *jhum* cultivation. The authorities have instituted various initiatives, including the establishment of model villages, the Cash Crop Plantation Scheme, and the Composite Scheme, among others. The state government, in conjunction with the KAAC, has instituted a range of State Plan Schemes aimed at curbing the practice of shifting cultivation among the Karbi community. A range of initiatives referred to as the Compact Areas Programme and the Mini Compact Areas Programme were executed within the framework of the IIJDP and also recently the KAAC underwent a transformation and initiated strategies aimed at promoting the cultivation of sustainable cash crops such as tea, coffee, rubber, bamboo, and sugarcane. This initiative resulted in the establishment of commercial agroforestry schemes in the

study area. In light of the introduction of these initiatives, there was a notable expression of discontent among the people regarding the process, and the number of beneficiaries remained remarkably low, leading to a resurgence of shifting cultivation practices. This trend indicates that government initiatives lack dynamism in the implementation of the schemes. The rate of success is comparatively diminished in contrast to other regions of the country and also it does not fall within the anticipated range set by the government. However, a significant trend emerges; should the government implement these schemes properly, one could anticipate a constructive transformation in shifting cultivation (ICFRE, 2020).

In light of the changing agricultural practices in forest regions of the country, this study argued that agroforestry is pivotal in transforming the lives of the local people. It enhances agricultural productivity, diversifies income sources, restores ecological equilibrium in farmlands, conserves forest resources, mitigates climate change, and addresses issues such as soil erosion and water management, among other benefits. Consequently, agroforestry emerges as a potent approach to enhancing biodiversity through the creation of diverse and interconnected ecosystems that foster a wide array of plant and animal species within the terrestrial landscapes. This study also argued that it is imperative to emphasize the necessity of safeguarding the fragile ecosystems of the hill regions, ensuring that the inhabitants of these areas reap the benefits while simultaneously alleviating the adverse effects stemming from the unsustainable exploitation of their resources, particularly land and forests. Historically, inhabitants of the hill regions have adjusted to the unique physiographic and climatic conditions by employing strategies such as terracing and *jhum* cultivation. Simultaneously, the government needs to safeguard the traditional practices associated with shifting cultivation. Undoubtedly, commercial agroforestry plays a significant role in the economic and social landscape of communities; however, it is vital to safeguard the fragile ecosystem while recognizing the traditional and cultural practices of the tribes that have traditionally connected with the hill economy.

Conclusion

This study looked at the shifting crop pattern systems in the *jhum* areas of three forest divisions in Karbi Anglong. The local government (KAAC) framed several schemes to conserve three essential natural resources: soil, water, and vegetation, and these schemes have had a significant impact on the socioeconomic lives of the people in the studied area. According to the study, the Cash Crops Development Programme played an important role in people's lives; however, the beneficiaries of such schemes were limited in the study area, as shown in the tables. This study also found that commercial crops grown under agroforestry systems are partially causing the decline of traditional shifting cultivation practices, which could have a significant influence on people’s socio-cultural lives. It should be noted that the local people are concerned that if commercial crops continue, it would result in the loss of culture and traditional agricultural practices, which they have been practising for a long time and cannot be separated from their cultural life. However, such opinions have a smaller percentage. Though cash crop schemes can help people earn more income, they cannot be imposed on them without creating proper awareness about the issues and problems associated with *jhum* cultivation, as well as the ecological prospects of agroforestry, for which the government must take some steps to

change. However, accepting the changing scenario of agricultural practices in the hill areas of Karbi Anglong, this study can conclude that agroforestry plays a significant role in the changing life of the people, as well as improving agricultural productivity and diversifying income streams, restoring ecological balance in farmlands, conserving forest resources, mitigating climate change, reducing soil erosion, water management, and so on. Thus, agroforestry is an effective strategy for increasing biodiversity by establishing various and interconnected ecosystems that support a vast range of plant and animal species in the terrain lands.

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Author 1*	*Author 2*	*Author 3*	*Author 4*
Conceived and designed the research or analysis	Yes	Yes	Yes	No
Collected the data	Yes	No	No	No
Contributed to data analysis & interpretation	Yes	No	No	No
Wrote the article/paper	Yes	Yes	No	Yes
Critical revision of the article/paper	Yes	Yes	Yes	No
Editing of the article/paper	Yes	No	No	Yes
Supervision	No	Yes	Yes	Yes
Project Administration	Yes	No	No	Yes
Funding Acquisition	Yes	No	Yes	No
Overall Contribution Proportion (%)	35	25	20	20

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Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has involved Indigenous Peoples as participants or respondents. The contexts of Indigenous Peoples or Indigenous Knowledge were only indirectly covered through literature review. Therefore, a Self-Declaration in this regard applies in case of this study or written work, and is appended.

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The author(s) solemnly declare(s) that this research has not directly involved any local community participants or respondents belonging to non-Indigenous peoples. Neither this study involved any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or prior informed consent (PIC) of the respondents or Self-Declaration in this regard does not apply in cases of this study or written work.

(Optional) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)
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To see original copy of these declarations signed by Corresponding/First Author (on behalf of other co-authors too), please download associated zip folder [Declarations] from the published Abstract page accessible through and linked with the DOI: https://doi.org/10.33002/nr2581.6853.070303.

SELF-DECLARATION FORM

Research on Indigenous Peoples and/or Traditional Knowledge

1. Conditions of the Research

1.1 Was or will the research (be) conducted on (an) Indigenous land, including reserve, settlement, and land governed under a self-government rule/agreement or?

No

1.2 Did/does any of the criteria for participation include membership in an Indigenous community, group of communities, or organization, including urban Indigenous populations?

No

1.3 Did/does the research seek inputs from participants (members of the Indigenous community) regarding a community's cultural heritage, artifacts, traditional knowledge, biocultural or biological resources or unique characteristics/practices?

No

1.4 Did/will Aboriginal identity or membership in an Indigenous community used or be used as a variable for the purposes of analysis?

No

2. Community Engagement

2.1 If you answered "Yes" to questions 1.1, 1.2, 1.3 or 1.4, have you initiated or do you intend to initiate an engagement process with the Indigenous collective, community or communities for this study?

No Applicable

2.2 If you answered "Yes" to question 2.1, describe the process that you have followed or will follow with to community engagement. Include any documentation of consultations (*i.e., formal research agreement, letter of approval, PIC, email communications, etc*.) and the role or position of those consulted, including their names if appropriate:

Not Applicable.

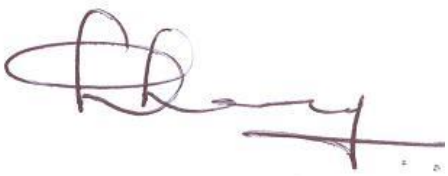
3. No Community Consultation or Engagement

If you answered "No" to question 2.1, briefly describe why community engagement will not be sought and how you can conduct a study that respects Aboriginal/ Indigenous communities and participants in the absence of community engagement.

The present study titled: "**Assessment of Commercial Agroforestry and Government Initiatives in *Jhum* Areas of Karbi Anglong, Assam, India**", involves community participation, however, the research participants of the present study does not belong to any Aboriginal/ Indigenous communities, which were officially classified and identified as the "Scheduled Tribes", by the Ministry of Tribal Affairs – The Government of India.

Name of Principal Researcher: Vulli Dhanaraju
Affiliation of Principal Researcher: Professor, Department of History, North-Eastern Hill University (NEHU) Shillong, Meghalaya, India.

Signature:



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